Precision Ag Insights/ IDC Update

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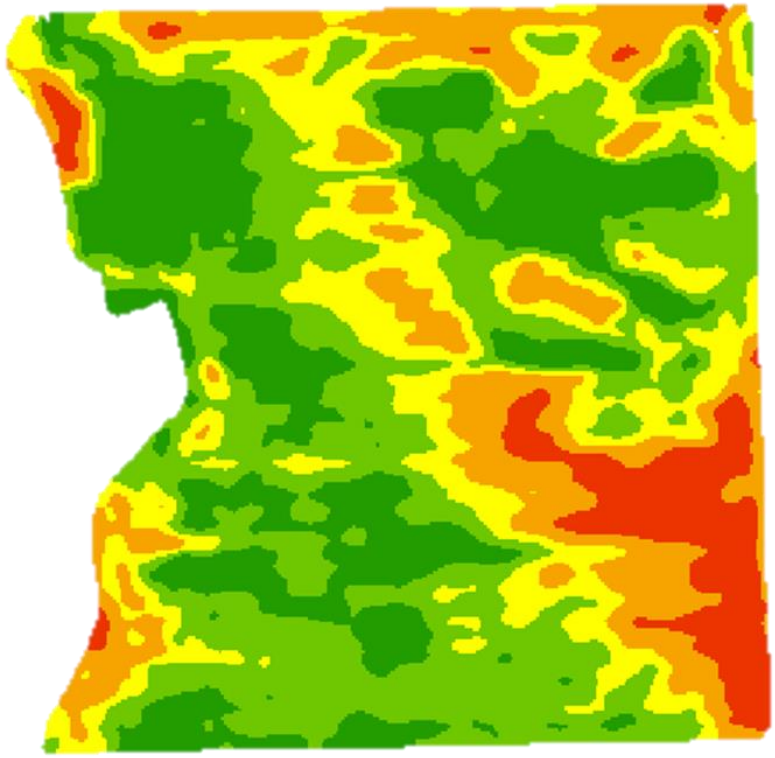
PRE- Sidedress Soil Sampling

Zone Color	Fall 2014 0-24" Nitrogen Soil Test
Dark Green	14 lb/acre
Light Green	14 lb/acre
Yellow	18 lb/acre
Orange	23 lb/acre
Red	15 lb/ac

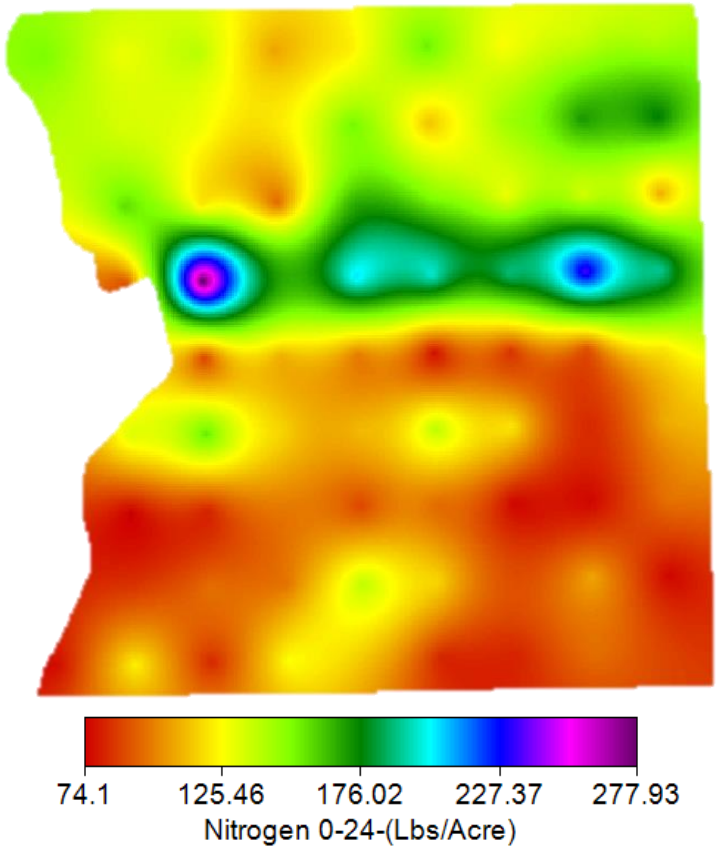


Management Zones

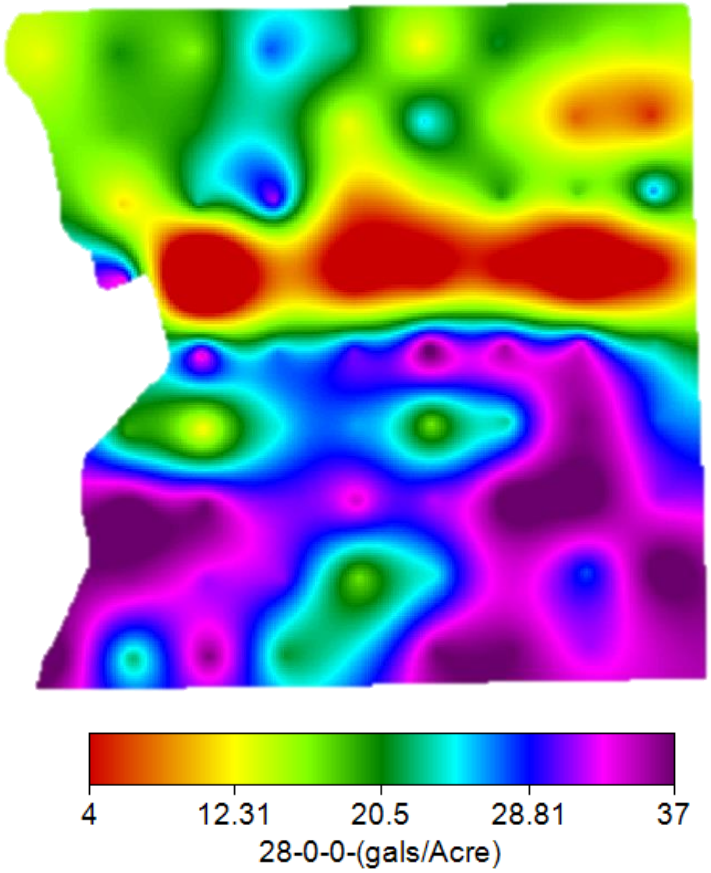
- **Spring applied, pre-plant, flat-rate application**
  - **100 lb/acre AMS + 140 lb/acre urea**
  - **Intent to vrt sidedress with 28-0-0 via coulter application**

PRE- Sidedress Soil Sampling

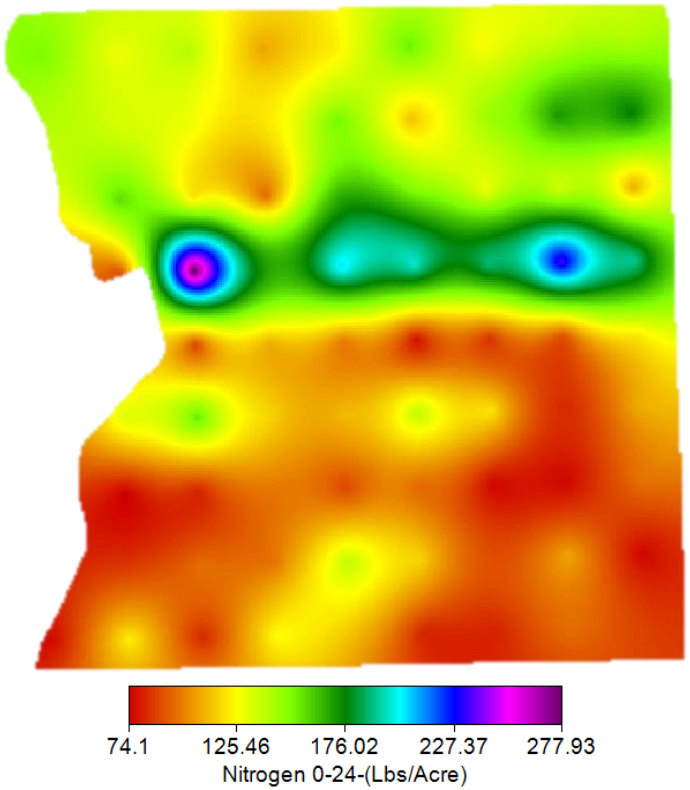
Soil Test Nitrate-N 0-24”

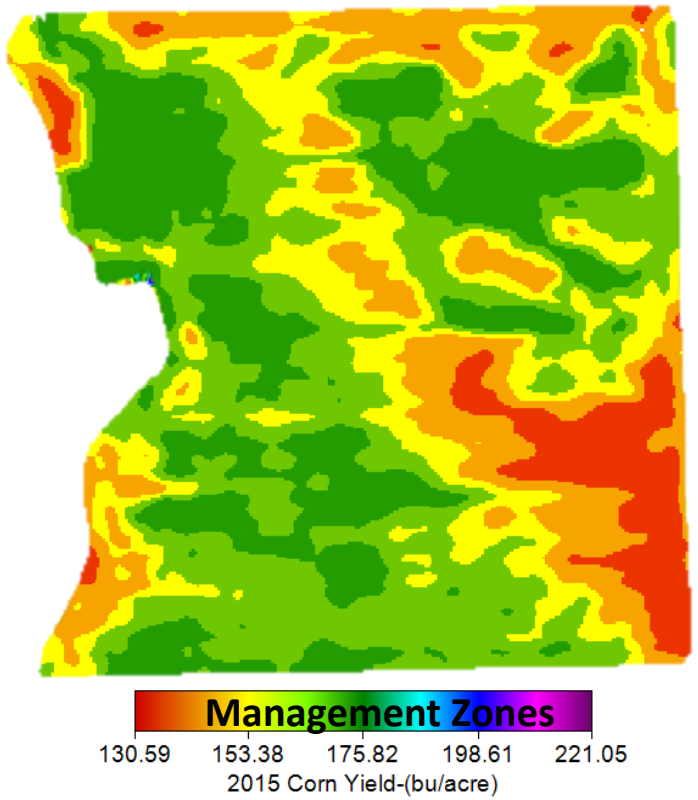


Sidedress 28% VRT Prescription



PRE- Sidedress Soil Sampling





Layer Name	Nitrogen 0-24”
Management Zones	0.241
2015 Corn Yield	0.047

PRE- Sidedress Soil Sampling

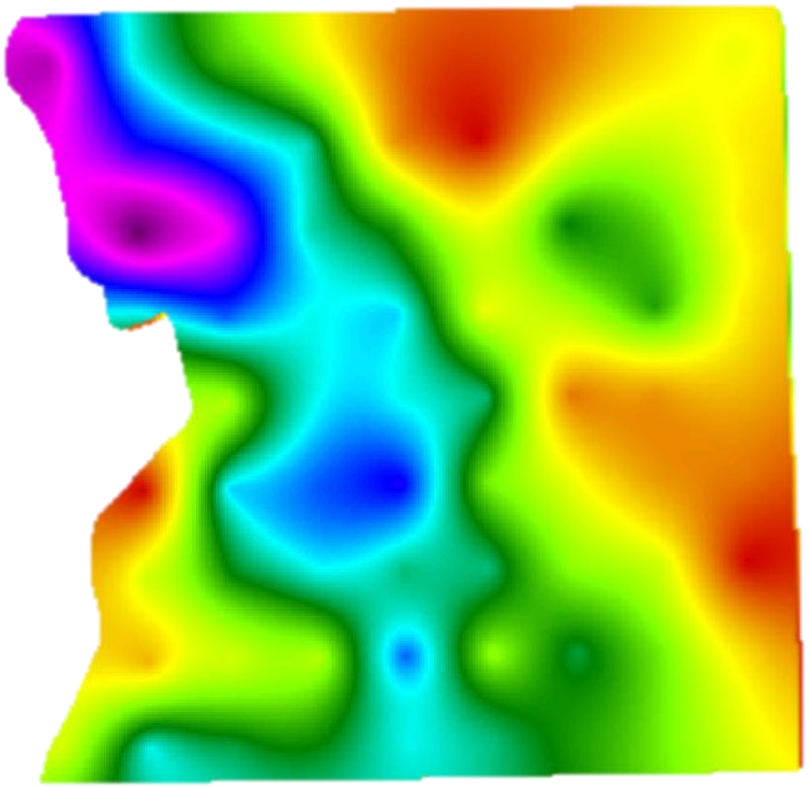
- Research found that a critical level of around 19-25 ppm Nitrate-N in 0-12” sample for PRE-sidedress soil sample

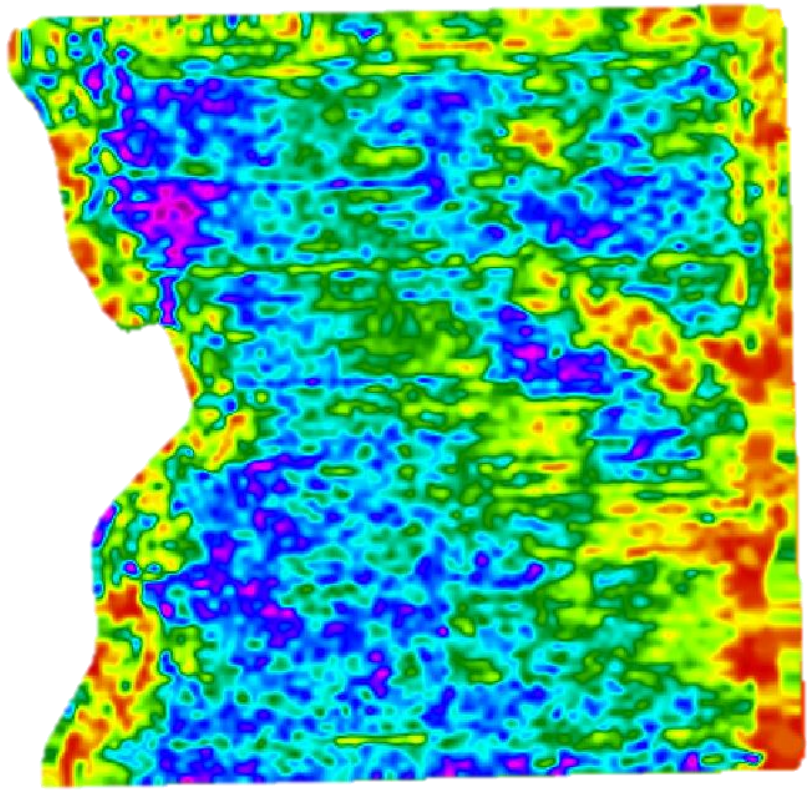
- Previous crop matters:
  - PRE-sidedress soil sampling did not consistently predict amount of N needed when the previous crop soybean and wheat
  - PRE-sidedress soil sampling was more predictive for sidedress N management in corn on corn

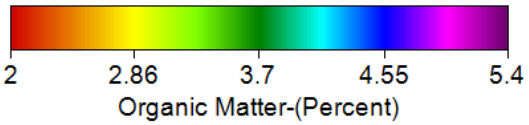
- UMN Extension publications recommend that Western and Northwestern MN remain using fall or early spring soil samples to determine Nitrogen fertilizer needs.

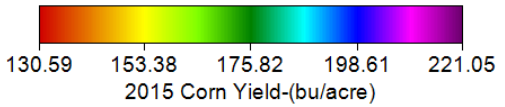
- Difficult to predict the amount of N mineralization from a PRE-sidedress soil sample

Sidedress Nitrate-N Soil Sampling









Correlation Coefficient between 2015 Organic Matter and 2015 Corn Yield
0.387

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Diagnosis of Potential IDC Soils

Risk of iron chlorosis in soybeans based on salinity and $CaCO_3$ content of soil

$CaCO_3$, %	Salinity, mmho/cm			
	< 0.25	0.26-0.5	0.51 - 1.0	> 1.0
0 - 2.5	Low	Low	**	High
2.6 - 5.0	Moderate	Moderate	High	V. High
> 5.1	Moderate	High	V. High	Extreme

** Low if $CaCO_3$ is less than 1%, moderate if $CaCO_3$ is 1-2.5%

Iron Chlorosis in Soybean

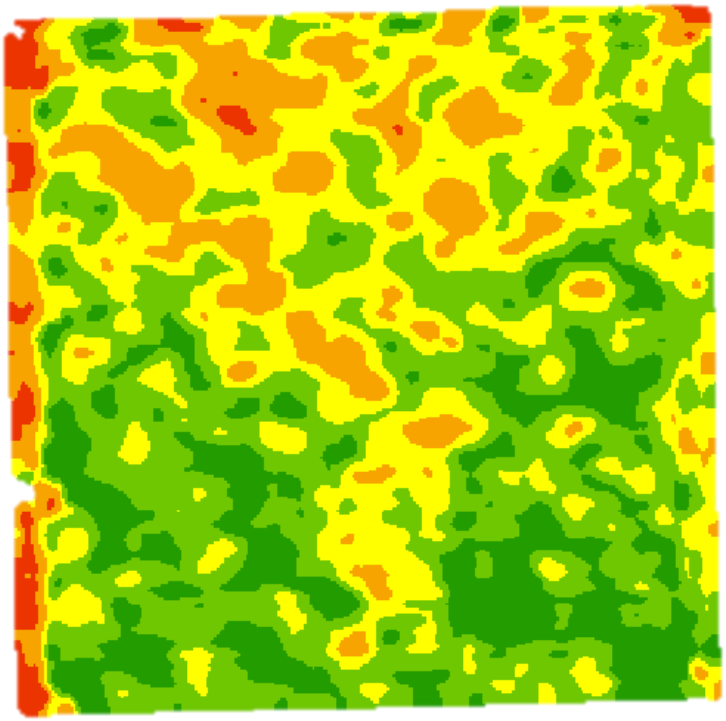
Zones for Managing IDC

- Zones from imagery for IDC?

- Light & Dark Green
  - Soil pH – 8.1
  - Salts 0-6 – 0.45 mmhos/cm
  - Salts 6-24 – 0.45 mmhos/cm
  - CCE% 0-6 – 2.3%
  - CCE% 6-24 – 7.2%

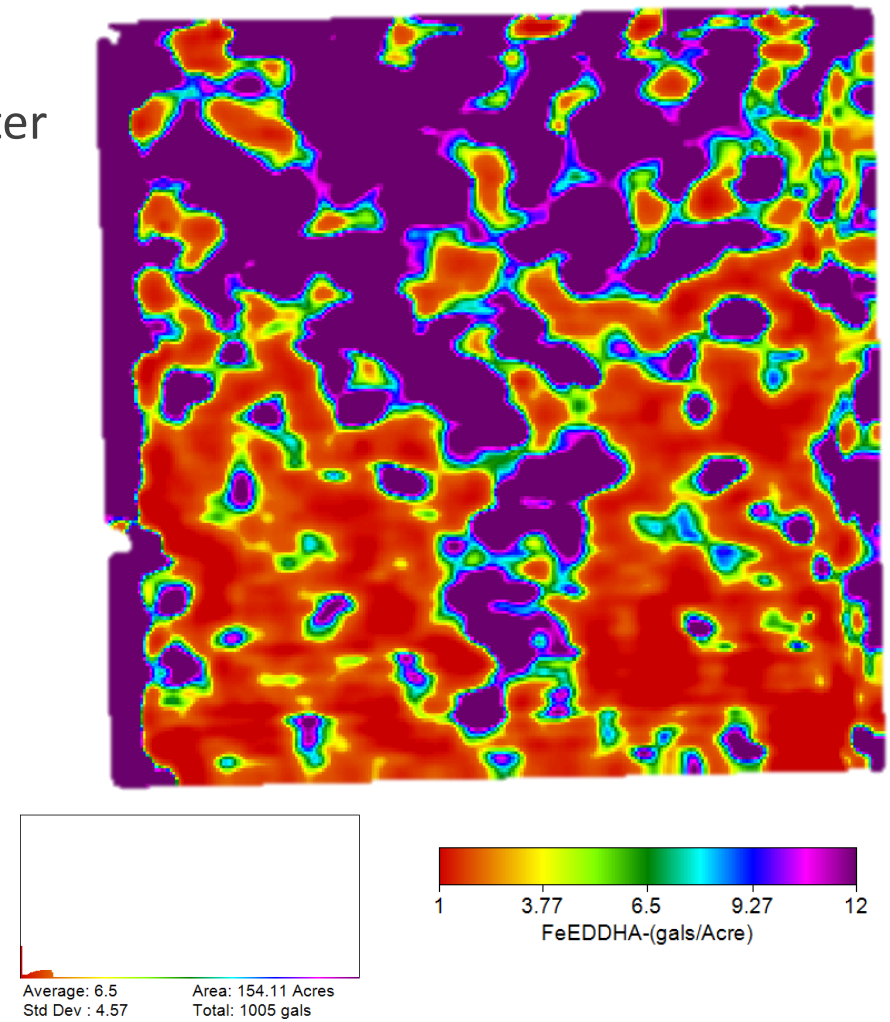
- Yellow
  - Soil pH – 8.1
  - Salts 0-6 – 0.54 mmhos/cm
  - Salts 6-24 – 1.03 mmhos/cm
  - CCE% 0-6 – 3.3%
  - CCE% 6-24 – 9.4%

- Orange & Red
  - Soil pH - 8.0
  - Salts 0-6 – 1.56 mmhos/cm
  - Salts 6-24 – 2.39 mmhos/cm
  - CCE% 0-6 – 9.5%
  - CCE% 6-24 – 9.5%

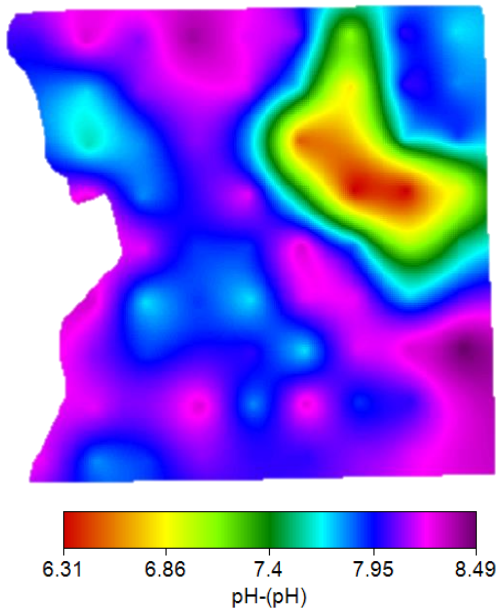


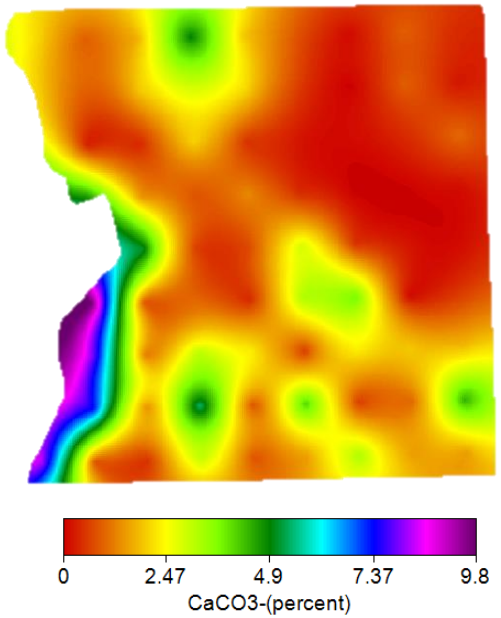
Zones for Managing IDC

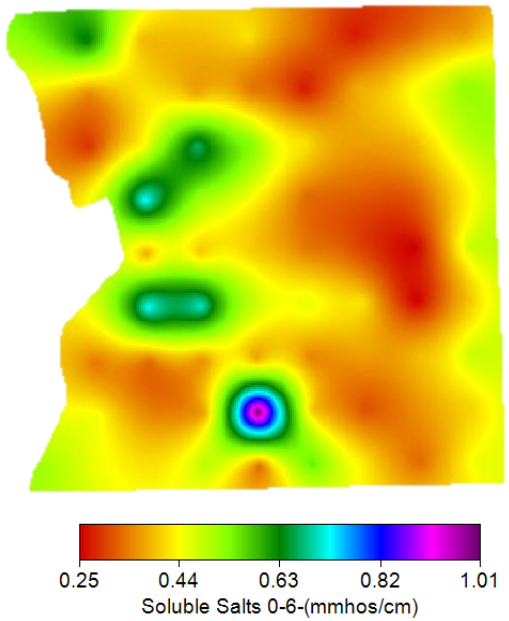
- Assumes that FeEDDHA is mixed with water in a ratio of 1 lb to 2 gallons of water
- Require 502.5 lb of FeEDDHA total
- This would equate to a 3.26 lb/acre rate

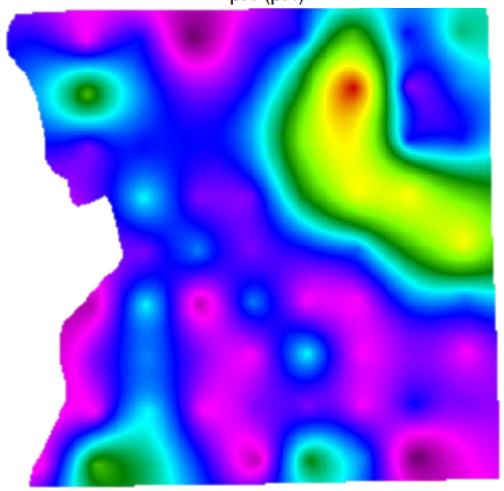


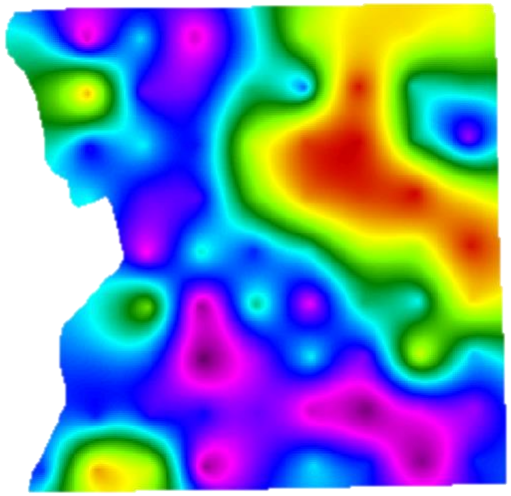
Grid Sampling for IDC Management

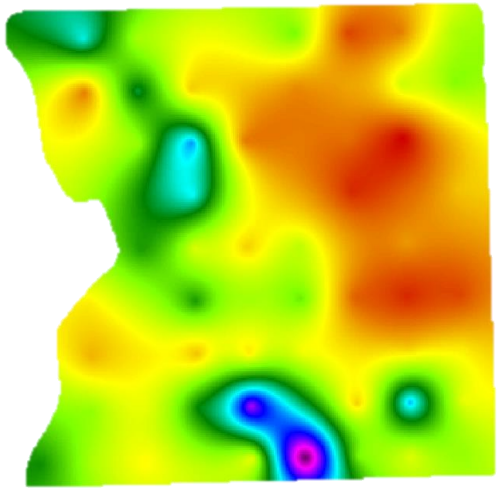






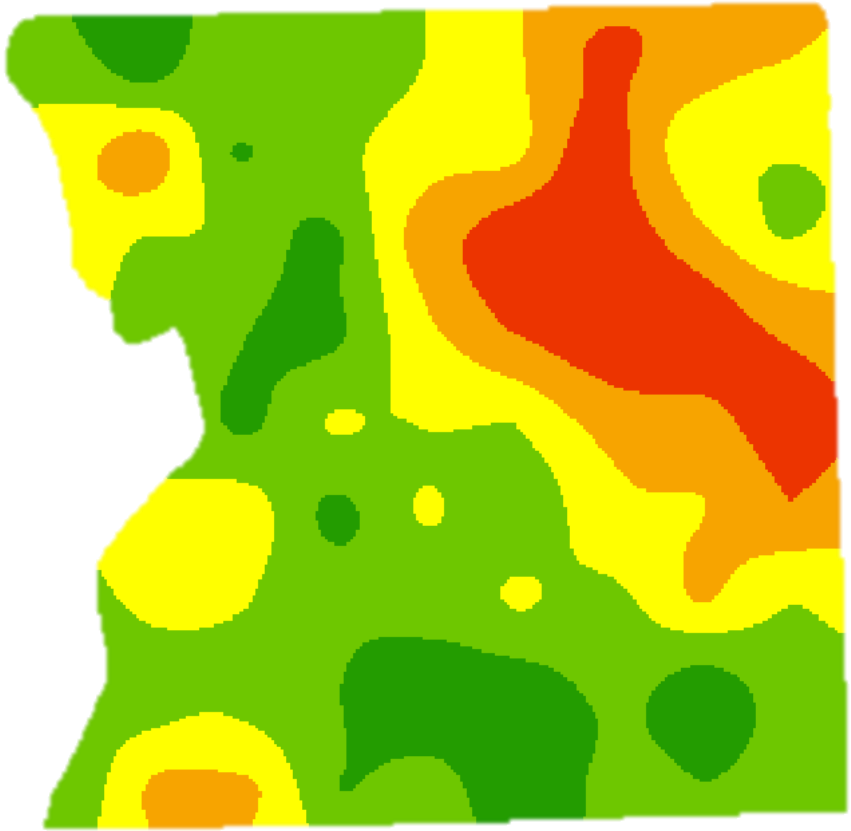




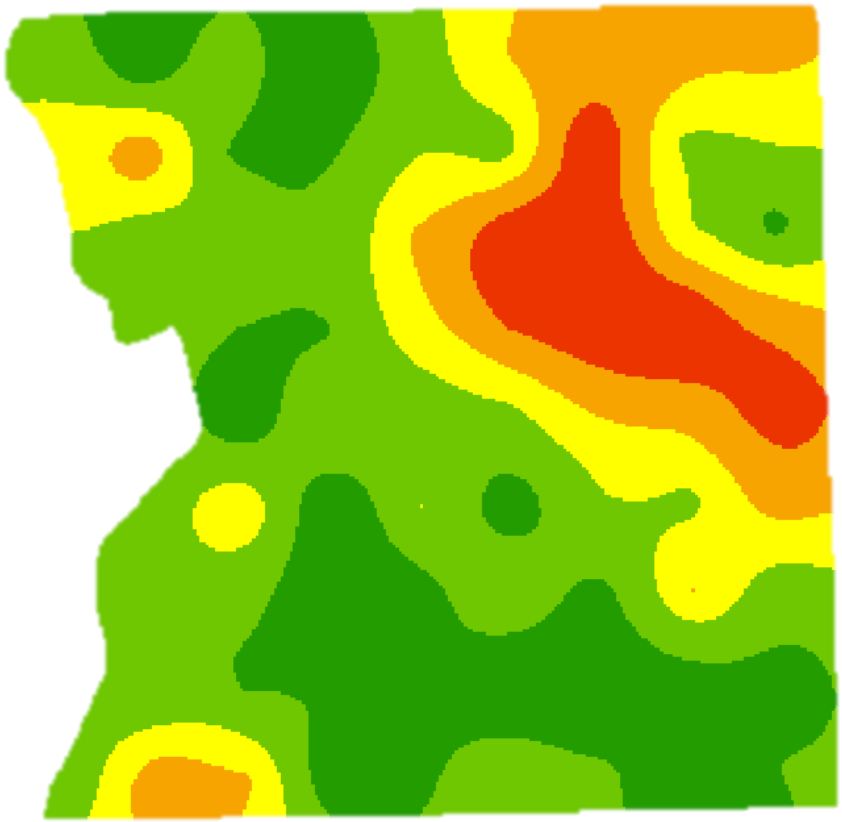


Grid Sampling for IDC Management

Maps Created by combining:



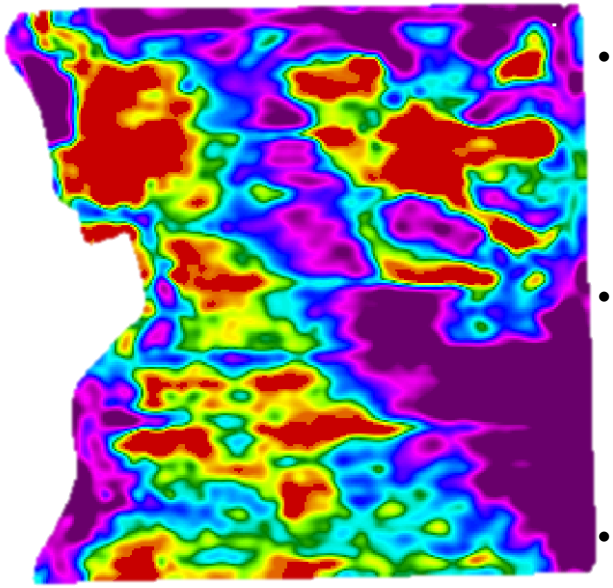
- 0-6” soil pH
- 6-24” Soluble Salts
- 6-24” CaCO3

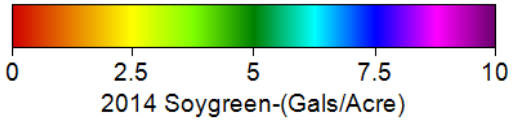


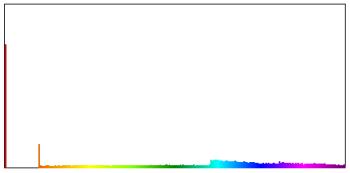
- 0-6” soil pH
- 6-24” CaCO3

Spring 2016 FeEDDHA Prescription

2014 FeEDDHA Prescription



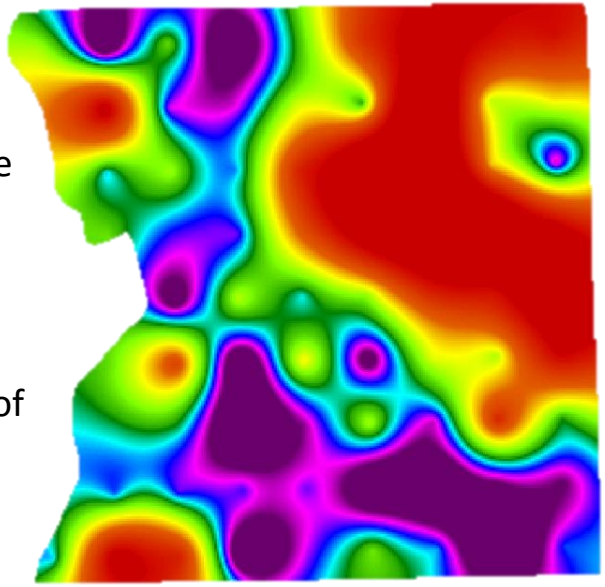


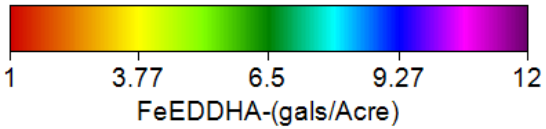


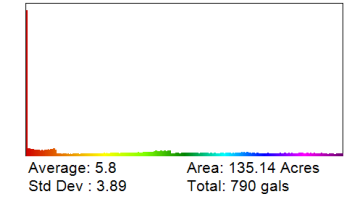
- 2016 Prescription based on 6-26" $CaCO_3$ and 0-6" Soil pH
  - Rate varies from 0.5-6 lb/acre of FeEDDHA
- 2014 Prescription based on management zones
  - Rate varies from 0-5 lb/acre of FeEDDHA
- Both 2014 and 2016 Prescriptions require approximately 400 lb of FeEDDHA for the field

Equates to approximately 3 lb/acre if it was a flat rate

2016 FeEDDHA Prescription







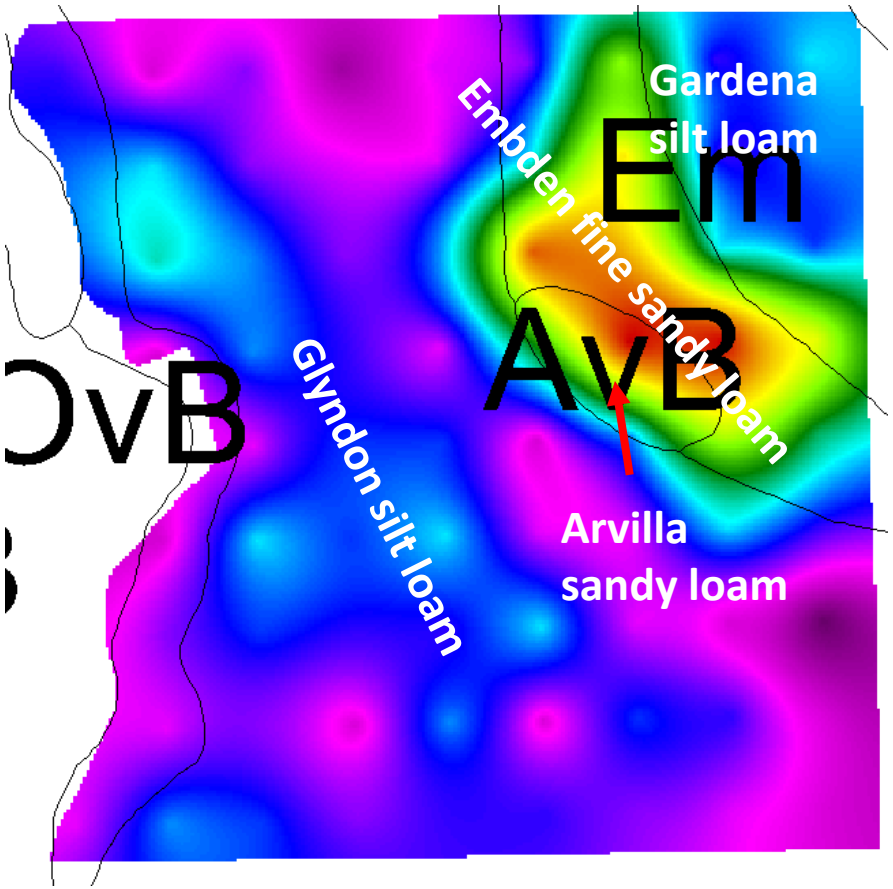
Variable-Rate Lime Application

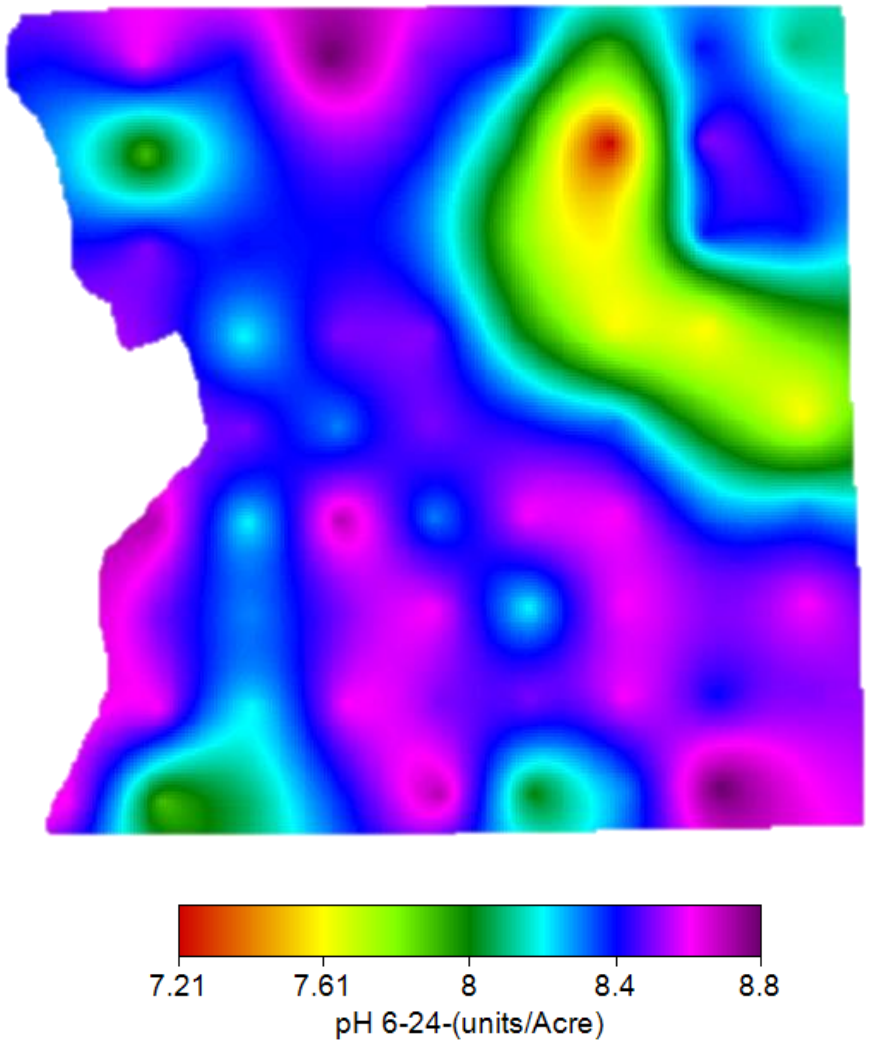
- Soils with relatively low soil pH are being found in geographies where low pH is generally not characteristic
  - John Lee of Agvise presented last year on an Embden Sandy Loam not too far from Northwood with a soil pH of 4.8
  - Grid sampling has revealed spots in fields that have lower soil pH's than what zones or composite sampling has shown

- These areas in the Red River Valley are relatively close to sugarbeet plants, which have spent beet lime available

- So:
  - Are there places on my own farm with soil pH's of less than 6.5?
  - Can we VRT Lime spots in fields where the soil pH is low?

Variable-Rate Lime Application

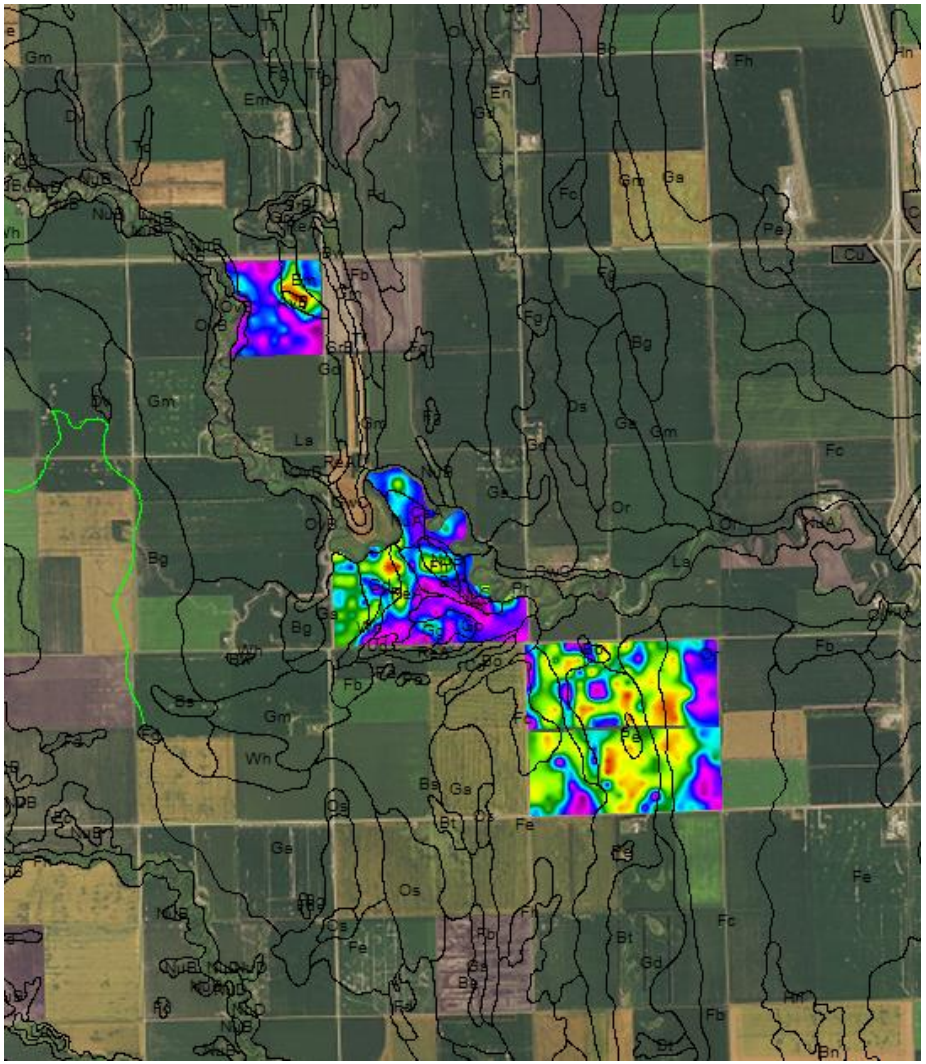




Variable-Rate Lime Application

- Grid sampling revealed 4 fields with areas where the soil pH is less than 6.5
  - 235 acres has soil pH of 6.5 or less
  - 346 acre has a soil pH of 7.6 or greater

- They are found on a ridge west of Hillsboro, ND



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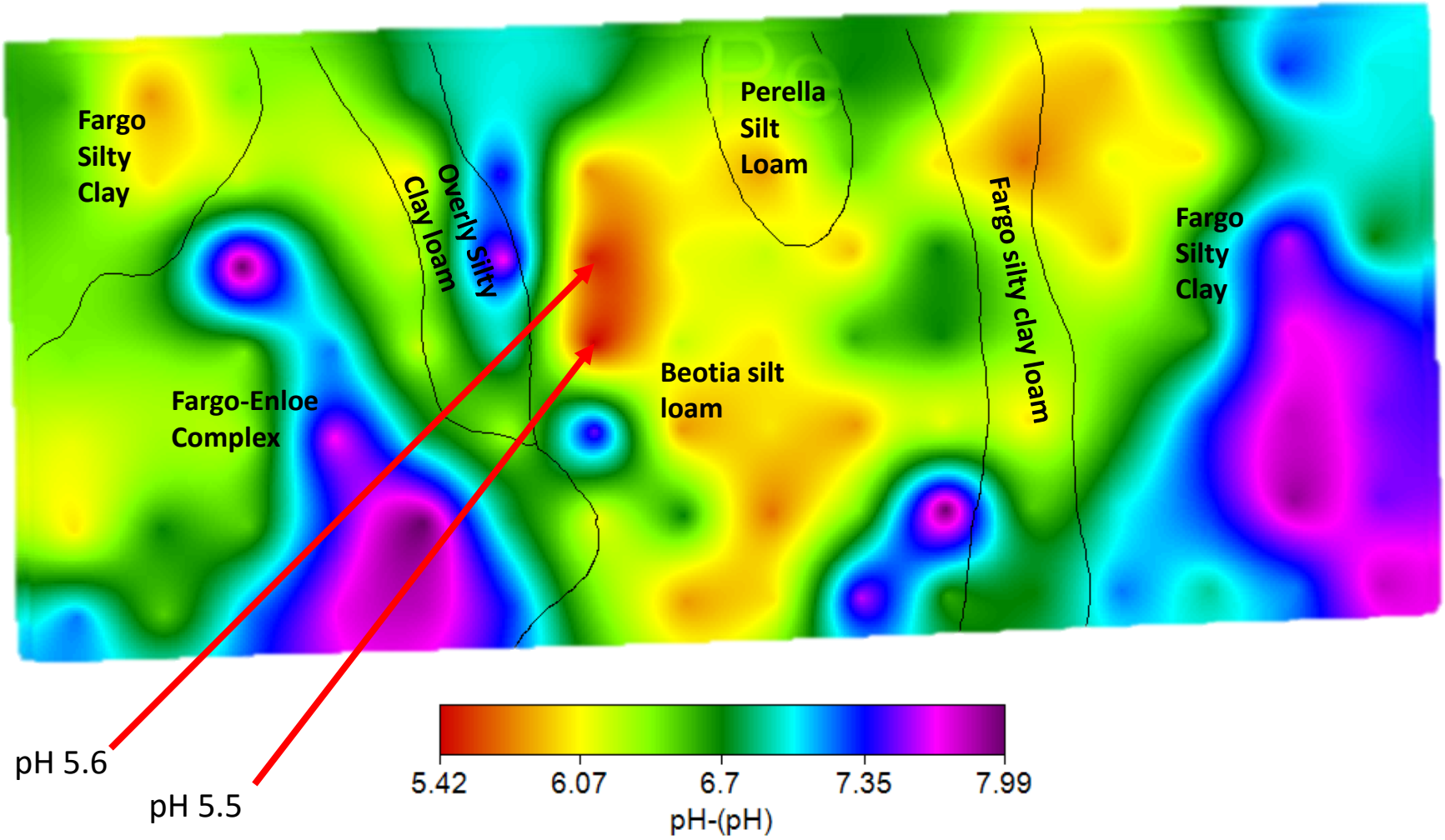


BEOTIA SERIES

The Beotia series consists of very deep, well drained or moderately well drained soils formed in silty glaciolacustrine deposits on lake plains. Saturated hydraulic conductivity is moderately high in the solum and moderately high to moderately low in the underlying material. Slopes range from 0 to 6 percent. Mean annual air temperature is 43 degrees F, and mean annual precipitation is about 19 inches.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, frigid Pachic Hapludolls

TYPICAL PEDON: Beotia silt loam - on a plane slope of less than 1 percent in a cultivated field. When described the soil was dry to 53 inches and moist below. (Colors are for dry soil unless otherwise stated.)

Ap--0 to 7 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; neutral; abrupt smooth boundary.

A--7 to 11 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; neutral; clear smooth boundary. (Combined A horizons are 8 to 16 inches thick.)

Bw1--11 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; neutral; clear smooth boundary.

Bw2--16 to 20 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; neutral; abrupt wavy boundary. (Combined Bw horizons are 8 to 28 inches thick.)

Bk1--20 to 32 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; few fine accumulations of carbonate; violent effervescence (34 percent calcium carbonate); moderately alkaline; gradual smooth boundary.

Bk2--32 to 42 inches; pale yellow (2.5Y 8/4) silt loam, light olive brown (2.5Y 5/4) moist; weak very coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine pores; few fine nests of gypsum and other salts; few fine accumulations of carbonate; violent effervescence (25 percent calcium carbonate); moderately alkaline; clear smooth boundary. (Combined Bk horizons are 10 to 29 inches thick.)

C--42 to 60 inches; pale yellow (2.5Y 8/4) silt loam, light olive brown (2.5Y 5/4) moist; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) redox concentrations and common fine prominent gray (10YR 6/1) moist redox depletions; massive, varved; slightly hard, friable, slightly sticky and slightly plastic; few fine mostly horizontal pores; slight effervescence; moderately alkaline.

TYPE LOCATION: Brown County, South Dakota; about 5 miles east of Bath; 2370 feet north and 125 feet east of southwest corner of sec. 18, T. 123 N., R. 61 W.

RANGE IN CHARACTERISTICS: The mollic epipedon ranges from 16 to 30 inches in thickness and extends into the Bw horizon. The control section typically is silt loam with between 18 and 27 percent clay. The depth to free calcium carbonate ranges from 16 to about 30 inches.

The A horizon has value of 3 or 4 and 2 or 3 moist, and chroma of 1.5 or less. It ranges from slightly acid to slightly alkaline.

The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6 and 2 to 4 moist, and chroma of 1 to 3. It is silt loam or silty clay loam. Reaction is slightly acid to slightly alkaline.

The Bk horizon has hue of 2.5Y or 10YR, value of 5 to 8 and 4 to 6 moist, and chroma of 2 to 4. It is silt loam or silty clay loam and is slightly or moderately alkaline. The calcium carbonate equivalent ranges from 20 to 35 percent. Few or common nests of gypsum and other salts are visible in the lower part of the Bk horizon in most pedons.

The C horizon has value of 6 to 8 and 4 to 6 moist, and chroma of 2 to 4. It is silt loam or silty clay loam and typically is varved with very thin strata of very fine sand, to clay. Varves range from less than 1 mm to 10 mm in thickness. Few or common nests of gypsum or other salts are visible in the C horizon of some pedons. It is slightly alkaline or moderately alkaline. Few to many, faint or distinct redox features are in the lower part of the C horizon in most pedons. Sand and gravel are below a depth of 40 inches in some pedons. Other pedons may have loamy glacial till below a depth of 40 inches.

COMPETING SERIES: These are the Brookings, Overly, Tara, and Waubay series. Similar soils are the Athelwold, Estelline, Gardena, Grassna, Great Bend, LaDelle, and Sinai series. Brookings and Tara soils have loam or clay loam within depths of 40 inches. Overly soils contain more than 27 percent clay in the series control section. Waubay soils formed have mottles within depths of 40 inches. Athelwold and Estelline soils have sand and gravel within depths of 40 inches. Gardena soils are coarse-silty. Grassna soils have a drier soil moisture control section for longer periods. Great Bend soils have mollic epipedons less than 16 inches thick. LaDelle soils have an irregular decrease in organic matter with depth. Sinai soils have a fine textured control section.

GEOGRAPHIC SETTING: Beotia soils are on nearly level to gently sloping lake plains having plane and convex surfaces. Slope gradients typically are less than 4 percent but range from 0 to 6 percent. The soils formed in varved silty glaciolacustrine deposits with thin lenses of very fine sand to clay sized particles. Mean annual air temperature ranges from 38 to 45 degrees F, mean annual precipitation from 16 to 24 inches, and P-E indices from 38 to 50. Most of the precipitation comes in the spring and summer. Growing season is about 120 to 130 days; average growing season precipitation ranges from 14 to 18 inches; and growing degree days are about 2500 to 3000.

Variable-Rate Lime Application- Conclusion

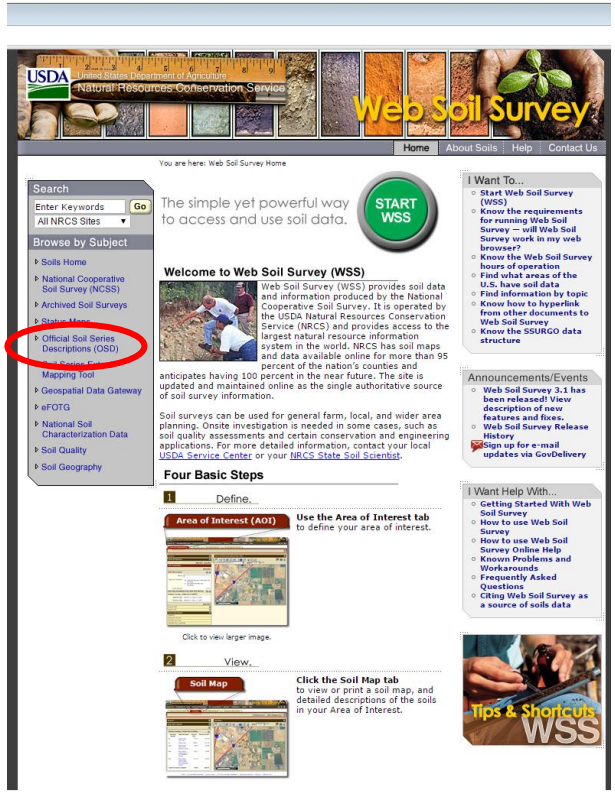
- Grid Sampling is useful in determining areas within fields with low soil pH's

- Next steps:
  - Develop soil pH zones from grid data
  - Zone sample with a 0-6" and 6-24"
  - Have buffer pH soil testing information to determine lime requirement
  - Develop a variable rate prescription for lime application


Questions??

Official Soil Series Description

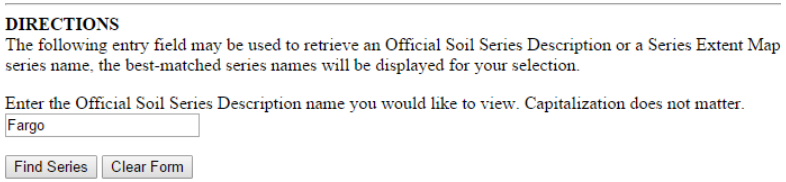
- What do you mean Fargo Clay or Glyndon Loam?
- Fargo and Glyndon are names of soil series. These names can be looked up to help us understand a little more about these soil series
- Google search “Web Soil Survey” or go to http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
- Click on “Official Soil Series Descriptions (OSD)



Official Series Description

- Click on “View OSD by Series Name (with best-match feature”)

- Type in the Name and click “Find Series”



LOCATION FARGO ND+MN MT

Established Series
Rev. NDP-KAA-JJB
07/2015

FARGO SERIES

The Fargo series consists of very deep, poorly drained and very poorly drained, slowly permeable soils that formed in calcareous, clayey lacustrine sediments. These soils are on glacial lake plains, floodplains, and gently sloping side slopes of streams within glacial lake plains. Slopes range from 0 to 2 percent. Mean annual air temperature is about 5 degrees C, and mean annual precipitation is about 575 millimeters.

TAXONOMIC CLASS: Fine, smectitic, frigid Typic Epiaquerts

TYPICAL PEDON: Fargo silty clay, in a map unit of Fargo silty clay, 0 to 1 percent slopes, on a level plane slope on a lake plane, in a cultivated field. (Colors are for moist soil unless otherwise stated)

Ap--0 to 20 centimeters; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to strong fine granular; very hard, blocks friable, granules firm, very sticky and very plastic; many fine roots; many fine pores; neutral (pH 7.2); abrupt smooth boundary.

A--20 to 33 centimeters; black (10YR 2/1) and very dark gray (10YR 3/1) crushed and rubbed silty clay, very dark gray (10YR 3/1) and dark gray (10YR 4/1) crushed and rubbed, dry; moderate medium subangular blocky structure parting to strong very fine angular blocky; extremely hard, firm, very sticky and very plastic; many fine roots; many fine pores; faces of peds have shiny waxy sheen when moist; neutral (pH 7.0); abrupt wavy boundary.

Bss--33 to 53 centimeters; very dark gray (2.5Y 3/1) and very dark grayish brown (2.5Y 3/2) silty clay, gray (2.5Y 5/1) and dark grayish brown (2.5Y 4/2) dry; dark grayish brown (2.5Y 4/2) crushed and rubbed, grayish brown (2.5Y 5/2) dry; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderate coarse prismatic structure parting to strong fine and very fine angular blocky; extremely hard, firm, very sticky and very plastic; common fine roots; common pores; slickensides on vertical faces of peds; faces of blocks have waxy sheen when moist; slight effervescence in lower part, noneffervescent on tongues; cracks filled with A material throughout; slightly alkaline (pH 7.6); abrupt irregular boundary.

Bkg--53 to 81 centimeters; olive gray (5Y 5/2) silty clay, light gray (5Y 7/2) dry; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; weak medium subangular blocky structure parting to moderate fine angular blocky and granular; hard, friable, sticky and plastic; few roots; common fine pores; cracks filled with A material extend into this horizon; common fine masses of carbonates; strong effervescence; moderately alkaline (pH 8.0); clear wavy boundary.

Cg1--81 to 122 centimeters; grayish brown (2.5Y 5/2) silty clay, light gray (2.5Y 7/2) dry; common medium distinct brown (10YR 4/3) redoximorphic concentrations and gray (5Y 5/1) redoximorphic depletions; weak medium subangular blocky structure parting to moderate very fine angular blocky and granular; very hard, firm, very sticky and very plastic; few fine roots; common pores; strong effervescence; moderately alkaline (pH 8.0); gradual wavy boundary.

Cg2--122 to 173 centimeters; olive (5Y 4/3) and pale olive (5Y 6/3) silty clay, pale olive (5Y 6/3) and pale yellow (5Y 8/3) dry; many medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; laminated, fractures to moderate very fine blocky structure; very hard, firm, very sticky and very plastic; few medium masses of carbonates; slight effervescence; moderately alkaline (pH 8.0); gradual wavy boundary.

Cg3--173 to 200 centimeters; pale olive (5Y 6/3) silty clay; pale yellow (5Y 8/3) dry; common medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; laminated, fractures to moderate very fine subangular blocky structure; very hard, firm, very sticky and very plastic; common medium masses of carbonates; few fine masses of iron-manganese; slight effervescence; moderately alkaline.

TYPE LOCATION: Major Land Resource Area 56 - Red River Valley of the North (56); Traill County, North Dakota subset; about 9 miles south and 6 miles east of Hillsboro; 1170 feet south and 410 feet east of the northwest corner of sec. 29, T. 144 N., R. 49 W. Latitude 47 degrees, 15 minutes, 42.7 seconds N, Longitude 96 degrees, 55 minutes, 13.5 seconds W., NAD 83, Halstad SW, ND USGS 7.5 minute quadrangle.

RANGE IN CHARACTERISTICS:
Clay content of the particle size control section - typically 40 to 60 percent; however in some pedons material with less clay in the lower part of the control section results in an average between 35 and 40 percent.
Sand content of the particle size control section -- less the 15 percent fine sand and coarser
Rock fragments -- 0 percent
Thickness of the mollic epipedon -- 15 to 55 centimeters
Depth to carbonates -- 41 to 58 centimeters
Saline phases are recognized

Ap and A horizon:
Hue--10YR or 2.5Y

Can insert Schoolhouse CEC/Salinity to compare

Use the Leraas pit as one where it doesn’t work due to salinity??